New Species and Records of Hawaiian Sponges

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THREE PREVIOUS PAPERS on Hawaiian shallow-water sponges have appeared in *Pacific Science* (de Laubenfels, 1950, 1951, 1954). Repetition is here avoided, and it is assumed that the reader has consulted the earlier articles, especially that of 1950, on the sponges of Kaneohe Bay, Oahu. All of the sponges that are common about Oahu are described and named in that paper, and the key that is given there should be adequate. Further keys are inappropriate, because it is clear that almost any conceivable kind of sponge may be discovered in the next dredge haul. The present paper is based on three years' study, but it should be emphasized that even during the third year additional species were easily found.

Few references to the sponges of Oahu occur in the literature. Dr. C. H. Edmondson of the B. P. Bishop Museum in Honolulu has published (1946) on the reproduction of *Tethya*, but this is not a faunal paper. Casual references to sponges from Oahu occur, as discussed below, in some writings of Lendenfeld and Haeckel. A further reference may here be made to a paper by R. Baar (1903). He had a specimen "from Honolulu" that he identified (p. 30) as *Stelospongia lordii* Lendenfeld. Lendenfeld's species was a sponge from the Red Sea, and was described so vaguely that it might be a *Dysidea* or an *Ircinia*, or probably a *Polyfibrospongia*, but not even its generic allocation is clear. Baar's specimen was a macerated fragment that had lost all the significant bases for its identification. From his description one cannot even be sure to what family it belonged.

A bit of philosophy is indicated. Many sponge specimens are found in sea or on shore that cannot be identified. Often the sponge skeleton coheres for months after death, losing its characteristics bit by bit. Pathologic as well as moribund sponges get collected. Beach-worn skeletons flourish in museums. The author has been urged by museum authorities to identify EVERY specimen, when sound judgment indicated otherwise. Both Lendenfeld's and Baar's specimens above mentioned should have been frankly reported as unidentifiable, thus sparing the printer and reader alike.

DESCRIPTIONS OF SPECIES

Haliclona flabellodigitata Burton

The sponge thus identified was dredged 19 February 1948 from a depth of fifty meters, three kilometers south of Pearl Harbor. It was semi-incrusting, with convoluted lobes that were about 1 mm. thick. The entire sponge was not much more than 1 mm. thick, and covered an area about 1 cm. square. The color in life was whitish orange and the consistency was soft. The surface was not hispid, and (as is common in small sponges) no pores nor oscules were evident. There is no ectosomal specialization. The flagellate chambers are scattered, and generally about 35 microns in diameter. The skeleton comprises a few spic-

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ular tracts or fibers, with little spongin, only two to four spicules per cross section. The spicules are chiefly oxeas 2.5 to 3 by 160 microns. There are also numerous thinner spicules, 0.5 × 120 microns; these may be termed raphides, but on the other hand, may merely be juvenile forms of the larger spicules.

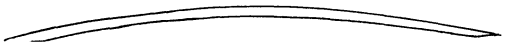

FIG. 1. Camera lucida drawing (× 635) of a typical spicule of the sponge identified as *Haliclona flabellodigitata*.

Burton (1934: 534) described *Haliclona flabellodigitatus* from northeastern Australia. His specimens, and that now under discussion, are notable within the large genus *Haliclona* for the relative thinness or slenderness of their oxeas. All *Haliclonas* are much like one another, and the question of "what is a species?" is even more perplexing in regard to this genus than for other genera. Spongologists are confident that many species of *Haliclona* exist, but for lack of striking characteristics have paid attention to small differences. It is far from certain that this Hawaiian sponge is conspecific with that described by Burton, but there is significant resemblance. It seems regrettable to add more and more new names in so crowded a genus, and therefore this tentative identification is made.

Xytopsues zukerani new species

This new name is based upon a single specimen, to be deposited in the U. S. National Museum, collected 14 February 1948 by dredging south of Diamond Head (Honolulu), at a depth of 75 meters. It was a small amorphous sponge, less than 1 cm. thick, less than 5 cm. in diameter. The color in life was orange, and the consistency of the soft sponge was obscured by its content of debris. There was no conspicuous dermal specialization, and the pores and oscules were closed,

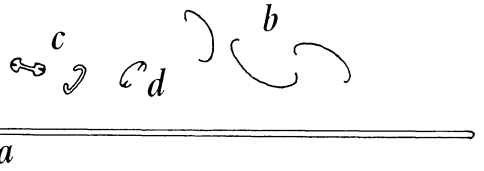

FIG. 2. Camera lucida drawing (× 635) of spicules of *Zytopsues zukerani*: *a*, Strongyle; *b*, sigmas; *c*, typical chela (arcuate) front and side views; *d*, a typical chela (unguiferate).

not evident. The sponge tissues held the mass together, but were otherwise confined to the interstices of a large quantity of calcareous sand. Some obviously foreign spicules were present, and in such cases as this it is always difficult (or impossible) to be sure which spicules are proper. The abundant, widely distributed ones are, however, probably proper. These include straight smooth strongyles 1.5 by 190 to 3 by 220 microns, contort sigmas 22 to 26 microns in chord length, and isochelas 12 microns long. The latter generally lie on one side in spicule preparations, as do palmate chelas that have narrow shovels. One isochela was found to be unguiferate, as illustrated in Figure 3*d*, but more seem to be arcuate, verging upon palmate, as shown in Figure 3*c*.

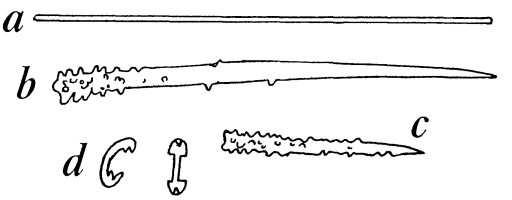

FIG. 3. Camera lucida drawing (× 635) of spicules of the sponge identified as *Lissodendoryx calypta*: *a*, Tornote; *b*, acanthostyle; *c*, echinating acanthostyle; *d*, arcuate isochela, side and front views.

The type of the genus *Xytopsues* was described as *Phoriospongia osburnensis* by George and Wilson (1919: 154) and transferred to *Xytopsues* by de Laubenfels (1936: 55). It was found at Beaufort, North Carolina. This western North Atlantic sponge is much like *X.*

zukerani except that its chelas have shafts that are pronouncedly curved, as in the letter "C." The other species already in *Xytopsues* was described as *Desmacidon griseus* by Schmidt (1870: 55). It is common in the West Indies and Bermuda, and is distinctive for its conspicuously unguiferate chelas. The species *zukerani* is thus characterized by its rather typically arcuate chelas and by its orange color. The name is given in recognition of the services to science of Lester Zukeran of the Hawaii Marine Laboratory.

Pellina sitiens Schmidt

The sponge thus identified was collected 29 March 1948 from a concrete dry dock at Pearl Harbor. It was out of water at the time of collection, but so placed as to be usually two or more meters under the surface. It covered an area about 5 × 7 cm. and consists mainly of oscular tubes 3 to 6 mm. in diameter; many of them attain a height of 2 cm. The walls of the tubes are paper-thin. The consistency is like that of wet paper. The surface is smooth, the pores not evident. The color in life was a pale dull yellow, the appearance well described as semi-transparent. The ectosome contained abundant spicules tangentially placed. The endosome was especially full of conspicuous flagellate chambers, round and 30 microns in diameter. The spicules are oxeas, chiefly in confused arrangements, and 15 × 450 to 12 × 480 microns in dimensions.

Ridley (1884: 414) described *Pellina eusiphona* from the Indian Ocean, and de Laubenfels (1954: 98) so identified a sponge from Ebon (Marshall Islands). The Hawaiian sponge is intermediate between that of the Western Pacific and Indian Ocean on the one hand, and the common North Atlantic species on the other hand. The latter was originally described as *Eumastia sitiens* by Schmidt (1870: 42). The Hawaiian specimen agrees in color with *sitiens*, and not with *eusiphona*, and it is possible that *eusiphona* should fall in synonymy with *sitiens*, although this step is not taken here. Another possibility, also rejected, but with misgivings, is that a new name might be needed for the Hawaiian *Pellina*.

Myxilla rosacea (Lieberkühn) Schmidt

This species has been reported from Kaneohe Bay (de Laubenfels, 1950: 17). The Hawaiian specimens there recorded were orange-red. On January 19, 1948 some others were found in Oahu with the clear red color that is characteristic of *Myxilla rosacea* elsewhere in the world.

Lissodendoryx calypta de Laubenfels

The sponge thus identified was dredged 14 February 1948 south of Diamond Head (Honolulu), Oahu, at a depth of about 30 meters. It was a thin incrustation, less than 1 mm. thick, of a rich carmine red color. The consistency was mediocre, the surface smooth, with no pores and oscules that could be certainly identified. The skeleton consists of spicules in confusion. There are straight smooth tornotes that may be regarded as ectosomal, 2 × 165 to 2.5 × 200 microns. The principal megascleres are acanthostyles 6×60 to 9×160 microns in dimensions. The smaller ones are spined throughout their entire length. The larger ones are smooth from the pointed end nearly halfway to the blunt end. The certain microscleres consist only of abundant isochelas of typical arcuate shape. Some extremely thin straight spicules may be raphides, but may more likely be juvenile tornotes.

Lissodendoryx calypta was described by de Laubenfels (1954*b:* 133) for a specimen from Eniwetok. It had smaller isochelas in addition to many like those in the Hawaiian specimen, and it lacked the larger acanthostyles, but the two agree in their lack of sigmas, lack of smooth styles, and thinness of incrustation.

Axechina lissa new species

This new name is based upon a single specimen, to be deposited in the U. S. Na-

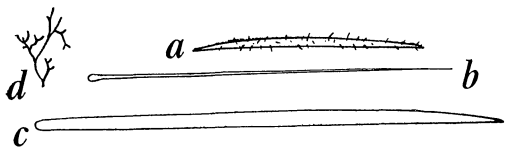

FIG. 4. Camera lucida drawing (× 635) of spicules of *Axechina lissa*: *a*, Microspined oxea; *b*, tylostyle; *c*, style; *d*, freehand sketch of the sponge × 0.3.

tional Museum, dredged 14 February 1948, near Koko Head, Oahu. It is ramose, with cylindrical dendritic branches 3 mm. in diameter, reaching a height of 7 cm. The color in life was a deep pink, which color was briefly transferred to the alcohol in which it was preserved. The surface is comparatively smooth, with no evident oscules, but with abundant pores each about 100 microns diameter, about 25 pores per square millimeter. There is a fleshy dermis about 20 microns thick. The spherical flagellate chambers are 25 to 30 microns in diameter. The endosome contains a reticulation of keratose fibers 12 to 30 microns in diameter, most commonly about 15 microns diameter. The smaller ones are cored by a single row of spicules, the large ones by as many as three spicules per cross section. The mesh of the reticulation is 50 to 100 microns in diameter, most often about 65 microns. The reticulation forms an axial core to the branches, about 1 mm. in diameter, but whereas it is generally a rather dense core, in places it opens to form a central hollow as much as 0.7 mm. diameter.

The spicules which lie in, or "core," the fibers are microspined oxeas, about 4 to 90 microns in dimensions. There are many smooth styles perpendicular both to the axial specialization and to the surface of the sponge, in plumose fashion, points out. These range from 6 × 185 microns as illustrated, up to 7 × 270 microns. There are also present thin tylostyles, often parallel to the axial specialization, their points towards the apices of the branches. These are typically 1 × 135 to 1.5 × 160 microns in dimensions.

This is the second species for the genus *Axechina*, which was established by Hentschel (1912: 417) for the species *raspailioides* from the East Indies. That and the present species agree in the raspailoid habitus, with an axial specialization of fibers cored with acanthoxeas, surrounded by radially placed smooth styles. Hentschel's species also had thin styles as long as 2200 microns, whereas the present sponge has instead the much smaller tylostyles. The East Indian sponge was strongly hispid, whereas the Hawaiian one is comparatively smooth; the specific name that is applied here is based on the Greek word for "smooth."

Eurypon distincta (Thiele) de Laubenfels

Sponges thus dubiously identified were dredged 14 February 1948 south of Diamond Head (Honolulu) at a depth of 75 meters, and 19 February 1948 south of Pearl Harbor, depth 50 meters. These were lipostomous crusts 100 to 300 microns thick, comparatively smooth, but microscopically hispid. This latter character results from a series of smooth tylostyles which generally are erect upon the substratum, points up. These spicules range from 10 to (generally) 17 microns thick, by 1000 or more microns long. Among them are numerous acanthostyles 6 × 75 to 8 × 60 microns in dimensions.

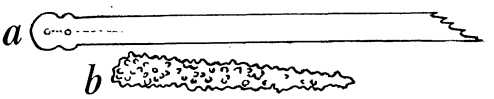

FIG. 5. Camera lucida drawing (×635) of spicules of the sponge identified as *Eurypon distincta*: *a*, Head portion only of a tylostyle, showing the double-headed condition that frequently occurred in Hawaiian specimens thus identified; *b*, acanthostyle.

These specimens were a lovely blue in life, but after preservation the color faded and the sponges could not be found on the masses of coralline material upon which they grew. It had been intended to describe them as a new species, based on the color, but this now seems inappropriate.

Thiele (1903: 956) described a sponge as *Hymeraphia distincta* from the East Indies. This was transferred to *Eurypon* by de Laubenfels (1936: 110). Thiele does not cite the color in life, but the spicules of his *distincta* are similar to those of the Hawaiian sponges now being discussed.

There is a sound criticism for the dubious identification that is here made: it tends to indicate a faunal relationship between Hawaii and the East Indies that is not certainly valid. It is more likely that the vivid blue Hawaiian *Eurypon* specimens really do represent a distinctive species.

Microciona haematodes new species

This species was dredged 10 April 1949 near Kaena Point, Oahu, at a depth of more than 200 meters. It was growing on other sponges, of the genera *Stellettinopsis* and *Dorypleres* (q.v.). Quite likely it also grew on other substrates in the vicinity, but was not picked up by the dredge except on the more massive sponges. It was a persistently thin crust much less than a millimeter thick but spreading laterally indefinitely. A number of patches were visible, each about as large as a postage

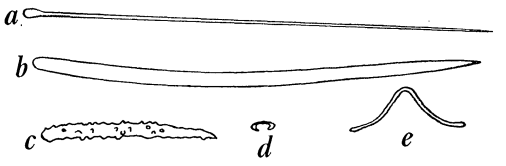

FIG. 6. Camera lucida drawing (× 635) of spicules of *Microciona haematodes*: *a*, Tylostyle; *b*, style; *c*, acanthostyle; *d*, isochela; *e*, toxa, perhaps foreign.

stamp, and nearly as thin. They were conspicuous because of their blood-red color. The name proposed here is derived from the Greek, meaning "blood stained." The specimens are to be deposited in the U. S. National Museum.

As is characteristic of such thin sponges, little can be said as to consistency, oscules, and pores. The skeleton is completely consistent with placement in the genus *Microciona*, and yet is remarkable. Typical members of this genus have a principal skeleton of smooth styles or subtylostyles arranged as fibers or tracts. The present species does contain a few, but only a few smooth styles, scattered and secondary. Typical *Microciona* has the tracts or fibers echinated by acanthostyles, which are generally scanty in numbers, even to the point of being difficult to find. The present species instead has principally acanthostyles of the echinating sort.

Comparison with the genus *Myxilla* is interesting. In that genus the spicules that apparently should be principal are rare, and the spiny echinating spicules abound. In *Myxilla* and in *haematodes* these acanthostyles form a distinctive isodictyal reticulation with many parallel spicules on each side of the triangular or polygonal meshes. This has been compared to a number of rooms built "log-cabin" style. In *Myxilla*, however, the dermal spicules are diactinal, whereas *haematodes* has monactinal ectospicules as in *Microciona*. The present species has palmate isochelas as typical of *Microciona*, but astonishingly almost or quite lacks the toxas that are present in nearly all species of *Microciona;* one was found, but was not certainly proper. Spicule dimensions are as follows: dermal tylostyles 2 × 200 to 4 × 400, generally 3 × 300 microns; smooth styles of the "coring" type 8 × 270 microns; acanthostyles 6 × 80 to 6 × 100 microns; palmate isochelas 15 microns long.

Microciona maunaloa de Laubenfels

This species has been reported (de Laubenfels 1951: 260) as occurring around the Island of Hawaii. A rather typical specimen was collected in Oahu 27 September 1947 in Waialua Bay at a depth between 4 and 8 meters. A *Microciona* collected 19 February 1948 south of Pearl Harbor may have been this species, but its toxas (?) were only once-bent instead of being the usual thrice-bent shape.

Ulosa rhoda new species

The type of this species was dredged 19 February 1948 at a depth of 50 meters, 3 kilometers south of Pearl Harbor. Another specimen was dredged 14 February 1948 at a depth of 20 meters, south of Diamond Head (Honolulu). The shape is cylindrical with, in each case, a single short branch. The diameter is about 2 cm. and the height about 8 cm. The consistency is spongy. The surface is coarsely cavernous, thus obscuring the pore-oscular situation. The caverns are about 1 mm. in diameter, representing the mesh of a fibro-reticulation of which the fiber ends often protrude from the surface. These fibers are 50 to 150 microns in diameter and contain many of the spicules, but there are also numerous spicules loose between the fibers. The spicules are all styles, varying generally from 13 × 400 to 15 × 310 microns; a few smaller ones are doubtless juveniles.

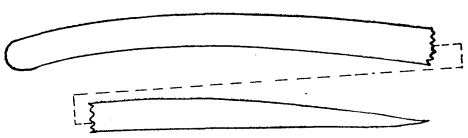

FIG. 7. Camera lucida drawing (× 635) of a typical spicule (Style) of *Ulosa rhoda*.

These sponges were particularly striking red in color when alive, and the name selected is based upon a Greek word for "rose." So far as is known, this color is unique in the genus.

Axinella solenoeides new species

This species was dredged 10 April 1949 at a depth of more than 200 meters, near Kaena Point. The specimens are to be deposited in the U. S. National Museum. It is a ramose sponge, with cylindrical branches 2 to 3 mm. in diameter, and up to 6 cm. high. The color in life was light red and the consistency flexible. The surface had the smoothness of velvet, and was lipostomous. As is typical of the genus *Axinella*, there is an axial specialization

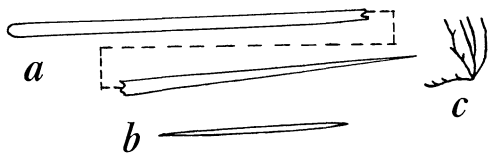

FIG. 8. Camera lucida drawing (× 635) of spicules of *Axinella solenoeides*: *a*, Style; *b*, oxea (Microxea); *c*, freehand sketch of the entire sponge, × 0.3.

comprising diactinal spicules, surrounded by outward-pointing monaxons. The axial specialization is generally a relatively solid core of fiber and spicule, and in places this is true of *solenoeides*, but in many places this sponge has an axial specialization that is a tube, with fibers and oxeote spicules around the hollow and parallel to it. The specific name is derived from a Greek word meaning "hollow," the distinctive characteristic of this new species. The oxeas vary from 1 × 60 to 3 × 90 microns; the styles of the plumose outer portion also vary considerably but are often about 4 × 160 microns in dimensions. The smaller oxeas may even constitute a category of raphides.

Homaxinella anamesa new species

This species was dredged 10 April 1949 at a depth of more than 200 meters, near Kaena Point. There were two separate collections; the type specimen is pronouncedly ramose with cylindrical branches 8 to 14, generally 10 mm. diameter. It reaches a height of 13 cm.

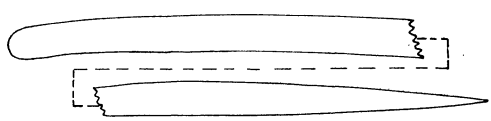

FIG. 9. Camera lucida drawing (× 635) of a typical spicule (Style) of *Homaxinella anamesa*.

The second specimen is somewhat flabellate due to lateral fusion of branches and is only about 7 cm. high. The color in life was bright vermillion red and the consistency spongy but easily torn. There was some obvious slime

production. The surface is conulose, with conules 1 mm. high and 2 to 3 mm. apart; between them are numerous apertures upwards of 1 mm. diameter and only 2 or 3 mm. apart on centers. Exhalant openings are not obviously differentiated from the inhalant ones. The skeleton consists of plumose tracts or fibers profusely echinated by smooth styles. This and the whole external appearance strongly resembles the *Homaxinella* (species *rudis*) that is so abundant in the Bermudas. That has styles 9 × 280 to 11 × 320 whereas the Hawaiian *Homaxinella* has styles 12 × 240 to 16 × 320 microns. The oscules are conspicuous in *rudis*. The other *Homaxinella* with the striking appearance of *rudis* and *anamesa* is *trachys* de Laubenfels (1954: 171) from Ebon, but its styles were much larger, 16×550 microns. The name *anamesa* is derived from a Greek adjective signifying "intermediate" or "in between." The specimens are to be deposited in the U. S. National Museum.

Densa distincta new species

This species was dredged 19 February 1948 at a depth of 50 meters, 3 kilometers south of Pearl Harbor. The specimen is to be deposited in the U. S. National Museum. It is an irregular mass, almost lobate, with projections about 3 or 4 mm. thick. The whole sponge is about 3 cm. diameter. The color in life was bright orange and the consistency dense, like cheese. The surface is smooth and lipostomous. The sponge is full of spicules in utter confusion. The majority are oxeas, but many are strongyles. The sizes range from 3 × 600 to 6 × 600 microns.

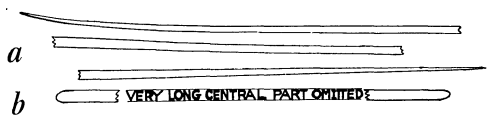

FIG. 10. Camera lucida drawing (× 635) of spicules of *Densa distincta*: *a*, A typical one of the oxeas, shown complete, but in three sections; *b*, the ends only of one of the strongyles, the long middle portion not shown.

This sponge answers to the definition of *Densa*, which is to say, *Hymeniacidon*-like, but with diactinal instead of monactinal spicules, but this is a heterogenous genus. The type, *Densa araminta* de Laubenfels (1934: 14), is a cavernous sponge with spicules of more commonplace proportions, whereas those of *distincta* are extraordinarily thin in proportion to their length. The other species that has been referred to this genus is *Densa mollis* de Laubenfels (1954: 191). It had small spicules and verged toward the genus *Collocalypta* by reason of mucous content, but *Collocalypta* has spongin fibers. Here is a genus of three species so diversified that their close relationship is questionable, yet they scarcely warrant erection of more new genera. The genus *Hymeniacidon*, which matches *Densa*, is similarly diversified and possibly polyphyletic.

Anthosigmella valentis new species

This species was dredged 10 April 1949 from a depth of more than 200 meters near Kaena Point. The specimen is to be deposited in the U. S. National Museum. It was a massive, rounded sponge, 2 × 5 × 9 cm. in size, dark drab in color, cartilaginous in consistency but packed with coarse calcareous sand. The oscules and pores appear to have closed. The surface is smooth, the interior finely cavernous, and (as noted above) full of debris. The skeleton comprises stout smooth tylostyles 7 × 300 to 9 × 425 microns in dimensions, and peculiar spirasters 10 to (rarely) 14 microns in chord measurement. These are essentially sigmoid microstrongyles with a single row of tuberculate processes.

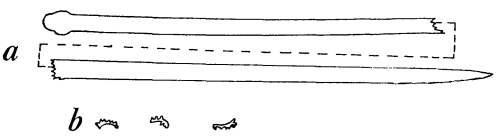

FIG. 11. Camera lucida drawing (× 635) of spicules of *Anthosigmella valentis*: *a*, Tylostyle; *b*, three of the distinctive microscleres.

There are also present microscleres that are intermediate between typical spirasters and the peculiar forms.

There are two species already in *Anthosigmella*, each widely distributed. The first was described as *Thalysias varians* by Duchassaing and Michelotti (1864: 86), and was made the type of *Anthosigmella* by Topsent (1918: 557). This sponge is abundant throughout the West Indian region. The second species was described as *Spirastrella vagabunda* by Ridley (1884: 468). It is abundant throughout the Indian Ocean, East Indies, Philippines, and the islands of the West Central Pacific. In comparison to these, *valentis* is distinctive for its extensive content of sand. In its smallness of oscule it is more like *varians* than *vagabunda*, and its microsclere shape is more like that in *varians*, but the microsclere size is even smaller than in *vagabunda*, which in turn averages smaller than in *varians*. *Valentis* is a Latin word meaning "vigorous, valiant, healthy."

Prosuberites oleteira new species

This species was collected 29 March 1948 on the Naval dry dock at Pearl Harbor. It was placed so as to be generally two or more meters below the surface, but would occasionally be out of water entirely, as at the time of collection. It occurred in at least three different places on the dock. Another specimen was dredged 14 February 1948 from 18 meters depth, south of Diamond Head (Honolulu).

This is a paper-thin sponge, of a vivid dark yellow color, verging toward orange, smooth to the naked eye, lipostomous and softly colloidal. Extensive subdermal spaces are present. The skeleton consists of tylostyles with rather flat heads, many are about 7 × 230 microns in size, but there is variation; some are nearly twice that length. There is a tendency for these spicules to be placed erect, heads at the substrate and points up and out. The flesh is so thin, however, (50 to 150 microns only) that the longer spicules merely lie in confusion.

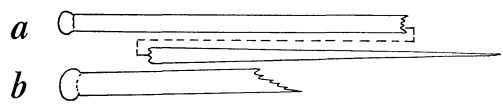

FIG. 12. Camera lucida drawing (× 635) of spicules of *Prosuberites oleteira*: *a*, Commonplace tylostyle; *b*, head only of a somewhat unusual sort that is common in this species.

The type is to be deposited in the U. S. National Museum.

The genus *Prosuberites* is a puzzling one. Burton (1934: 316) would drop all of it, and all of *Protosuberites* in synonymy to *Suberites*, assuming that the former two consist only of juvenile *Suberites*. The typical *Prosuberites*, however, has spicules far larger than those of *Suberites*, and (more important) does not have special dermal smaller tylostyles. There is good evidence that some of *Prosuberites*, like the Hawaiian sponge now being discussed, persistently remain encrusting, growing only laterally once they are established.

As for *Protosuberites*, there are only two species firmly placed therein, each established by Swarchewsky (1905: 36), and neither one satisfactorily described. Neither they nor the characters of the genus are adequately known. It is probably a synonym, perhaps of *Pseudosuberites*, but now has uncertain status.

In *Prosuberites*, there are now three names, established for Japanese sponges by Thiele (1898: 40); these are *sagamensis*, *exiguus*, and *inconspicuus*. All three are described with excessive brevity and must be regarded as ill-known. There seems to be, however, no clear reason for differentiating them from one another, and all seem to be juvenile *Suberites;* all three are here regarded as being *Suberites sagamensis*. *Alcyonium epiphytum* Lamarck (1815: 163) is also here transferred to *Suberites*, being a juvenile.

In *Prosuberites* there are now six species with relatively huge spicules. These spicules, however, differ radically in proportions from one

species to another. The six species include the type, *P. longispina*, and *P. incrustans*, *mexicensis*, *perforatus*, *rugosus*, and *sisyrnus*.

In *Prosuberites* there are now three species with smaller spicules, only a little larger than those that are typical of *Suberites*, but not differentiated into categories as are those of *Suberites*. These three are *brevispinus*, *epiphytoides*, and *brondstedi*. To them should be added the similar species described as *Hymeraphia spinularia* by Bowerbank (1875: 282). *Protosuberites brevispinus* was described by de Laubenfels (1951: 215), but the author had no opportunity to correct proof. Thus it happened that by accident the spicule size was omitted from the original publication: it was 6 × 520 to 6 × 550 microns.

Prosuberites oleteira has spicules a little larger than those of the four species that are discussed in the preceding paragraph, but much smaller than the spicules of the more typical six. It has a lethal effect which is not recorded for any of the others, and which may be unique. On the other hand, this characteristic may be present in one or more of the *brevispinus* type, in which case some synonymization might later be in order.

It was clear that *oleteira* was destroying other sessile forms as it spread its thin growth outward. Some encrusting sponges grow into interstices, or are left in interstices; these latter spaces are angular, with rounded protrusions entering them. The growth of *oleteira* instead made rounded lethal encroachments over its neighbors, which were chiefly ascidians and annelids of the type that form small calcareous tubes. The name *oleteira* is derived from a Greek word meaning "murderess."

Stellettinopsis kaena new species

This species was dredged 10 April 1949 near Kaena Point, from a depth of more than 200 meters. Two separate specimens were collected, both to be deposited in the U. S. National Museum. Each is an irregular mass.

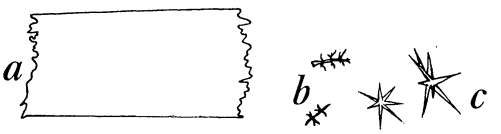

FIG. 13. Camera lucida drawing (× 635) of spicules of *Stellettinopsis kaena*: *a*, Central portion only of one of the oxeas to show its relative size; *b*, two of the sceptrelliform streptasters; *c*, two of the oxyeuasters.

That which is selected as type was 6 × 9 × 11 cm.; the other was 11 × 14 × 27 cm. The former was drab, darker at the surface than inside. The latter was so dark as to be nearly black. The consistency is cartilaginous and the surface is rough and lumpy. Both specimens contain foreign matter in scattered places, as though they had grown over neighboring organisms; this is not a case of incorporating foreign debris in proper skeletal structures. Both specimens were much overgrown as well. The type is nearly covered by patches of calcareous algae, the other specimen by a thin crust of *Microciona haematodes*. Both specimens are densely packed with large oxeas in confusion. These are somewhat larger in the type, ranging up to 36 × 2400 and 42 × 2000 microns in dimensions. In the other specimen sizes around 14 × 1000 microns are common. The microscleres include oxyeuasters 16 to (rarely) 20 microns in diameter, and streptasters uniformly about 12 microns in length. These show a pronounced tendency to have many spines arranged in two nodes that divide the spicule into equal thirds of length, no spines elsewhere except sometimes a few spines at the extreme ends.

Carter (1879: 349) described *Stellettinopsis simplex* from Australia. It has the sceptrelliform streptasters as in *kaena*, but they are 17 microns long, and are accompanied by diversified kinds of euasters. The other species which is most nearly like *kaena* was described from the Bermudas as *Stellettinopsis ketostea* (de Laubenfels, 1950: 112). The resemblance is indeed close, but *ketostea* had much larger euasters.

Dorypleres pleopora new species

The type of this species was dredged 19 February 1948 at a depth of 50 meters, 3 kilometers south of Pearl Harbor. A second specimen was dredged 10 April 1949 from a depth of more than 200 meters, near Kaena Point. The type specimen was a thin crust, but the second specimen was massive, 10×13×16 cm. in size. Each was bright lemon yellow and each darkened noticeably, to a sort of olive green or drab, after two or three weeks of preservation in alcohol. The consistency was cartilaginous. The surface was uneven, rough, but not especially hispid. No obviously exhalant openings were evident, but especially on the type specimen there were numerous scattered conspicuous pore sieves. In them the openings were 4×50 to 50×80 microns in size, and separated by narrow partitions only 40 microns thick. The ectosome contains more asters than the endosome; the latter is

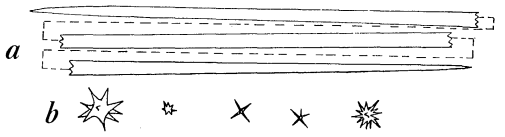

FIG. 14. Camera lucida drawing (× 635) of spicules of *Dorypleres pleopora*: *a*, One of the oxeas, shown complete, but in three sections; *b*, five of the asters.

packed with oxeas in confusion. These are 6×600, 8×600 to rarely 8×800 microns in dimensions in the type specimen, somewhat larger in the second specimen. The asters are of two distinct sorts. There are spherasters with many smooth, sharp rays, diameters 7 to 20 microns, with all intermediate sizes. There are also oxyeuasters regularly 10 microns in diameter, with few, often only 6 or 8 rays. The type is to be deposited in the U. S. National Museum.

The pore areas suggest those of the sponge described by Dendy (1916: 247) as *Aurora cribriporosa*, but that sponge had radiate symmetry and a thick cortex, two sizes of oxeas (one huge) and much larger asters. It never belonged in *Aurora*, which is a choristid genus; nevertheless *Aurora* needs attention because the name was preoccupied in 1887 by Ragonot for Lepidoptera, hence the following action is taken here:

Aurorella (new name) is here proposed for *Aurora* Sollas (1888: 187). The genotype is *Stelletta globostellata* Carter (1883: 353).

The above-mentioned *cribriporosa* has been put in *Rhabdastrella*, and so has *Diastra sterrastraea*, the genotype of *Diastra* Row (1911: 301). Because of its sterrasters, it is here proposed that *Diastra* be restored to full and valid generic standing. On the other hand, *Rhabdastrella* Thiele (1903: 934) is in no significant way different from *Dorypleres* Sollas (1888: 426), and should be dropped in synonymy to *Dorypleres*. Within this genus the other species closest to *pleopora* is *splendens* de Laubenfels (1954: 226) from Ponapé. These two species have oxeas much smaller than those of the other species of the genus, and little or no radiate structure; they conceivably might be given separate generic standing. *Dorypleres splendens* was bright orange, and its microscleres were spined; furthermore, it did not have obvious pore-sieves.

Erylus rotundus Lendenfeld

This species was dredged 19 February 1948 at a depth of 50 meters, 3 kilometers south

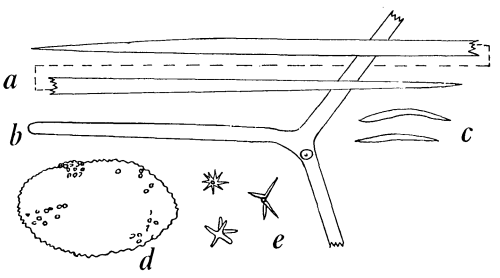

FIG. 15. Camera lucida drawing (× 635) of spicules of *Erylus rotundus*: *a*, Oxea; *b*, portion of a tetraxon spicule, only one of the four rays is shown complete, and one projects directly toward the observer; *c*, microxeas; *d*, solenaster; *e*, variations of form in tylasters.

of Pearl Harbor. There were two subspherical specimens, human fist size, nearly black exteriorly but drab as to interior. The consistency was cartilaginous. The oscules were about 1.5 mm. in diameter. The surface revealed numerous pores 70 to 140 microns in diameter. The ectosome is a cortex 100 microns and more in thickness. The endosome is vaguely radiate in architecture. The spicules are principally smooth oxeas, about 9 × 500 microns, but there are scattered tetraxons with rays about 7 × 140 microns. There are four kinds of microsclere. There are microxeas about 3 × 50 microns, often bent, indicating that they may represent large asters with rays reduced in number to two. There are microtuberculate chiasters or tylasters about 17 microns in diameter, with few rays, and others only 12 microns in diameter with many rays. Finally there are the peculiar aspidasters that characterize the genus *Erylus*. They are oval plates 3 microns thick and about 50 × 85 microns in surface size, completely covered with tubercles about 2 microns high and 2 microns in diameter. These plate-or-scale like spicules constitute a sort of dermal armour. They develop from asters, all of whose rays lie in a single plane.

In 1904 and 1905 Alexander Agassiz, aboard the U. S. Fish Commission Steamer "Albatross," collected in the Eastern Tropical Pacific. The vast numbers of sponges thus acquired are presumably in the collections of Harvard University at Cambridge, or in the U. S. National Museum. They were, almost immediately, made available for study by R. von Lendenfeld. In 1910 he published in the memoirs of the Museum of Comparative Zoology of Harvard a huge quarto volume on the family "Geodidae" (it should be Geodiidae) and another nearly as large on the family "Erylidae." In 1915 a massive two volume work appeared on the Hyalospongea thus collected. The volume on Geodiidae concerns only one certain genus, and scarcely a dozen valid species, which could be thoroughly described in 20 or 30 pages. The volume on Erylidae concerns less than half a dozen certain species, which could be appropriately described and discussed in about a dozen such large pages. The volumes in question are masterpieces of verbosity.

The scientists who travelled on the "Albatross" found no hyalosponges near Hawaii, nor any *Geodias*, but did find an *Erylus*. As was his custom, Lendenfeld made three species and two additional subspecies for it. Using his criteria, the specimen described above would be yet another species, and the next one collected in the future would be yet another. Lendenfeld used the names *rotundus*, *caliculatus*, and *sollasii;* the latter two of these names are here dropped in synonymy to *rotundus* (page 290), with some misgivings that all may possibly be synonyms of *Erylus nobilis* Thiele (1900: 48). Lendenfeld records his *Erylus caliculatus* from north of the Island of Hawaii, *Erylus sollasii* from south of Molokai, his *Erylus rotundus* from near Hawaii, and also from Hawaii and Molokai.

(?) **Leucosolenia vesicula** (Haeckel) Dendy and Row

Haeckel (1872: 41) described a remarkable sort of sponge, calling it first *Ascetta vesicula*, then later calling it *Clistolynthus vesicula*. He states that he found four specimens of it on floating Sargasso-weed, collected by Captain Halterman in the neighborhood of Honolulu. The weed was densely covered with hydroids and bryozoans. All four examples of *vesicula* were hollow balls with no trace of an oscule, total size 2 to 3 mm. in diameter. The only spicules present were sagittal triaxons with rays 10 × 80 to 12 × 90 microns in dimensions. It seems highly probable that these were immediate post-fixation stages of some sponge that may have appeared quite different when adult–this could even have been a juvenile *Leuconia* or (more likely) a *Leucetta*.

FRESHWATER SPONGES OF OAHU

In April 1941 Professor Arthur Svihla of the University of Washington sent the author

a manuscript describing freshwater sponges that he had personally found at Haepuaena on the Hawaiian Island of Maui and that Otto Degener had found on Oahu. Professor Svihla identified these as *Heteromeyenia baileyii* new subspecies. The present author concluded from the excellent descriptions rendered that they were typical *baileyii*, not a new variety. Therefore Professor Svihla so published them in a short article in SCIENCE.

Otto Degener and the present author repeatedly collected freshwater sponges on Oahu. They are common in the streams on the west or leeward side of the Koolau Mountains. These sponges look very much like *Heteromeyenia*, and closely resemble *H. baileyii* in particular. A perplexing difficulty, however, arises.

The genus *Heteromeyenia* is set off from the otherwise similar genus *Meyenia* by a difference in the special gemmule spicules. In *Meyenia* these are birotulate or amphidisc microscleres all of a single category. In *Heteromeyenia* there are similar amphidiscs, but also a second category of much longer, attenuated amphidiscs occurs among them.

The present author collected many specimens from various Oahu locations, and from each many gemmules. Numerous microscopic preparations were made, and studied for many hours. He was never able to find a single example of the second type of microscleres; every one of the specimens keyed to *Meyenia*, not to *Heteromeyenia*.

The Oahu specimens do not match any of the species that have been described in the genus *Meyenia*. They do fit perfectly the species *baileyii* of *Heteromeyenia* in every respect except the one that is used to separate that genus from *Meyenia*. The opinion is here expressed that they are indeed *baileyii*, but that those in Oahu have a most perplexing rarity of a critical characteristic. It would be interesting if the Oahu freshwater sponges were examined on successive years, and at various times per year; perhaps there is a time when the *Heteromeyenia* characteristic appears.

DISTRIBUTIONAL NOTES

Waialua Bay was studied 27 September 1947, chiefly by face-plate diving. The following sponges were found: *Spongia oceania*, *Haliclona permollis* (?), *Xytopsiphum kaneohe*, *Callyspongia diffusa* (?), *Toxadocia violacea*, *Microciona maunaloa*, *Terpios zeteki*, *Cliona vastifica*, *Zaplethes digonoxea*, and *Leucetta solida*.

On 18 October 1947 a study was made of a large, shallow, nearly enclosed area known as the West Loch of Pearl Harbor, in a part of it called Ulumoku Pond. Sponges were abundantly present. Two or three of these proved to be *Mycale cecila* but all of the many others were *Terpios zeteki*.

On 10 December 1947 an intensive study was made of the pilings in various portions of Honolulu Harbor. One interesting observation concerned the fact that where wastes from the pineapple canneries entered the harbor there were no sponges, and few other sessile invertebrates were present. The commonest animals on the pilings seemed to be: Finger-sized grey ascidians, annelids with calcareous tubes, erect bryozoa (*Bugula?*), bivalve mollusks (*Anomia* and *Ostrea?*), barnacles (*Balanus amphitrite?*), and, on nearly every piling, the sponge, *Mycale cecilia*.

On the 24th, 25th, and 26th of January 1948 an especially severe storm struck Oahu. On January 28th the beaches were studied from the southeast tip to the northwest side, for the wrack that is cast up by the waves. The only sponges found there were *Spongia oceania*. It seems to be commoner, and to grow larger, than any other Hawaiian sponge. The natives called sponges "upi," from their word for "to squeeze," also "hu'e hu'e kai," which means "foam of the sea."

On 14 February 1948 study was made both by diving and dredging near Koko Head (near Hanauma Bay). Vernon Brock, who was the most expert diver, reported that the bottom was liberally sprinkled with specimens that were obviously *Spongia oceania*. Others found included: *Xytopsues zukerani*, *Tedania ignis*,

Lissodendoryx calypta, *Axechina lissa*, *Eurypon distincta*, *Microciona maunaloa*, *Prosuberites oleteira*, *Ulosa rhoda*, and *Leucosoleonia eleanor*.

On 19 February 1948 dredging was carried on 2 to 3 kilometers south of Pearl Harbor. The following eleven sponge species were thus collected: *Hexadella pleochromata*, *Haliclona flabellodigitata*, *Tedania ignis*, *Lissodendoryx calypta*, *Eurypon distincta*, *Microciona maunaloa*, *Ulosa rhoda*, *Densa distincta*, *Dorypleres pleopora*, *Erylus rotundus*, and *Leucetta solida*.

This is an astonishingly great variety of Porifera to be found in such a limited area with but the one method of collecting.

On 11 March 1948 a study was made of barges that had been in Pearl Harbor for three years continuously, but on that day were finally put in dry dock for cleansing of their extremely foul bottoms. A barge that had been long at Kwajalein in the Marshall Islands, and then for three months at Pearl Harbor, was studied at the same time. The latter differed in sponge fauna from the former in having specimens of *Tethya*, and in lacking calcisponges. Six species occurred on both. This boat-bottom sponge fauna included: *Haliclona permollis* (?), *Pellina sitiens*, *Mycale cecilia*, *Prosuberites oleteira*, *Zygomycale parishii*, *Terpios zeteki*, *Tethya diploderma*, and *Leuconia kaiana*.

On 29 March 1948 another batch of ship bottoms was examined in dry dock; they revealed chiefly *Pellina*, *Mycale*, *Prosuberites*, and *Zygomycale*.

On 15 April 1948 still another batch of ship bottoms was examined in dry dock; these revealed *Mycale*, *Terpios* and *Zygomycale*.

On 10 April 1949 sponges were dredged near Kaena Point, at a depth of more than 200 meters. This collection included: *Microciona haematodes*, *Axinella solenoides*, *Homaxinella anamesa*, *Anthosigmella valentis*, *Stelletinopsis kaena*, and *Dorypleres pleopora*.

These are all new species, and the assortment is strikingly different from that of shallow water Oahu.

FAUNAL RELATIONSHIPS

The Hawaiian Islands are so isolated that, as may be expected, their shallow-water invertebrate fauna is largely endemic. This is emphatically true for the sponge fauna of Oahu, as outlined above. A minority of Hawaiian sponges show relationships to species from other parts of the world; these warrant further notice.

One Hawaiian sponge has been identified as being *Pellina sitiens*, properly a North Atlantic species. This identification is dubious, in that a new name may be needed for the Hawaiian *Pellina*, but some relationship is clearly indicated. On the other hand, *P. sitiens* may prove to be circumequatorial.

Oahu sponges have been identified with the following circumequatorial species: *Dysidea avara*, *Haliclona permollis*, *Myxilla rosacea*, *Tedania ignis*, *Zygomycale parishii*, *Cliona vastifica*, *Tethya diploderma*, *Plakortis simplex*, and *Leucetta solida*.

Five sponge species from Oahu have been identified with species that are not known to be circumequatorial, and which do occur to the west of the Hawaiian Islands. These are: *Haliclona flabellodigitata* (Australia), *Callyspongia diffusa* (Indian Ocean, East Indies, Micronesia), *Oscarella tenuis* (Australia), *Lissodendoryx calypta* (Eniwetok), and *Eurypon distincta* (East Indies).

It is worthy of notice that each of these five identifications is merely tentative and is certainly questionable. Each of the five may require a new name, indicating an endemic nature.

Five sponge species from Oahu have been identified with species that are not known to be circumequatorial, and which do occur to the east of the Hawaiian Islands. These are: *Adocia gellindra*, *Toxadocia violacea*, *Mycale cecilia*, *Terpios zeteki*, and *Leucosolenia eleanor*.

The opinion is here expressed that these identifications are more nearly certain, more dependable, than the preceding five identifications.

Ekman in his "Zoogeography of the Sea," page 19 and following, summarizes faunal relationships for the Hawaiian Islands as embodied in the literature. He had no data for the Porifera, but had ample data for most of the other great divisions of the animal kingdom. He reveals a pattern of great resemblance between the marine invertebrate faunas of Hawaii on the one hand, and those of the Asiatic-Australian-East Indian regions on the other hand. The fish faunas show this resemblance to an even greater degree. Other sources point to great resemblances between the floras of Hawaii and Asia.

Endemic species are rather more prominent in the Hawaiian sponge fauna than in faunas of other animal (and plant) groups. The few exotic sponge species show astonishingly little relationships to faunas of Asia, Australia and the East Indies. Relationship between Hawaiian sponges and those of the Pacific Coast of the Americas is not great, yet it is the most nearly worthy of attention as indicating zoogeographic affinity.

Could this American relationship be due to transport of sponges on ship bottoms? Sponges occur fairly commonly among the fouling organisms. With the possibility of transport in mind, studies were made of the bottoms of vessels in dry dock at Pearl Harbor. The results were inconclusive, but not negative. It seems clear that on a long ocean voyage most of the sponges on the ship's bottom perish, but a few might possibly survive.

TAXONOMIC NOTES

An important genus of Porifera has been known by the name of *Heteronema*, a name established by Keller (1889: 339). This name is even used in the author's 1946 monograph of the order Keratosa. It should not have been used, however, because it was preoccupied in 1841 by Dujardin for a protozoan.

The genus in question is characterized as resembling *Spongia*, but having foreign debris in the secondary fibers as well as in the primary fibers. This also was the diagnosis given by Lendenfeld (1885: 543), to his then new subgenus *Silicifibris* of the genus *Spongia*, hence this *Silicifibris* warrants attention.

The first species assigned to *Silicifibris* was the new species *galea*, here designated as the genotype. It was based on a macerated skeleton of a vase-shaped sponge, 25 cm. in diameter and height, with a sharp edged rim. This shape, and all details of the skeleton as described, match the long-established genus *Phyllospongia*.

The second species assigned to *Silicifibris* was Ridley's *Euspongia foliacea*. In a personal communication, Dr. Maurice Burton of the British Museum states that *foliacea* is a synonym of Carter's *Coscinoderma lanuginosum*, which has been transferred to *Phyllospongia*.

The third and last species assigned to *Silicifibris* was *silicata*, new, which may have been a *Dysidea*. The subgenus (or genus) *Silicifibris* should be regarded as a synonym of *Phyllospongia*. A new name is therefore required for the genus *Heteronema* as above described: ***Inodes,*** new name for *Heteronema* Keller (1889: 339).

Genotype: *Heteronema erecta* Keller 1889, page 339. Sponges of the family Spongiidae, with all the fibers, both primary and secondary, containing much foreign debris. The name is based on a Greek word meaning "fibrous."

Two other similar corrections require attention. In a paper by de Laubenfels (1955) the generic names *Walcottella* and *Waagenella* are established. The first of these was preoccupied by Ulrich and Bassler in 1931, for a crustacean. The second was preoccupied by Koninck in 1883, for a mollusk. New names are therefore required, as follows: ***Walcottium*** new name for *Walcottella* de Laubenfels (1955: 82). Genotype *Scyphia pertusa* Goldfuss 1833. ***Waagenium*** new name for *Waagenella* de Laubenfels (1955: 102). Genotype *Steinmannia salinaria* Waagen and Wentzel (1888: 979).

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